



VEL2231 Rev1.6

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# IPM™-200 Integrated Particulate Monitor

## Installation & User Guide

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Fuel Particle Contaminant Analyzer  
for Fixed Installation

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The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.

To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

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## 1 GENERAL DESCRIPTION

This product contains an infrared 5mW laser.

Any dismantling of the product may result in dangerous exposure to laser radiation. The following laser information is on a label on the top surface of the product:



**CAUTION:** Users are not required to access the laser radiation source and should never do so.

Parker Velcon's IPM-200 Series Fuel Contaminant Analyzers represent low cost alternatives to fuel contaminant monitoring, using the most up-to-date technology in solid particle contamination analysis. The IPM-200 Series are compact and ruggedized, permanently-mounted laser-based particle detector modules that provide a cost-effective solution to fluid management and contamination control. The primary difference between the IPM-200 Series is the data output protocol as outlined below;

IPM-210	CAN bus Output/Serial Output
IPM-230	Cellular or Telemetry Output

The IPM-200 Series comes standard with a hermetically sealed DB9 connector at the bottom of the enclosure, allowing the output of either CAN bus or Serial data to be interfaced directly to a dedicated PC so that ISO 4406 fuel cleanliness codes of 4, 6, 14, and 30 micron particle sizes can be monitored in real time. The IPM-230 also incorporates a Cellular or Telemetry module, allowing the monitoring of data anywhere in the world where an internet connection can be established.

### Features and Benefits

- Independent monitoring of system contamination trends.
- Calibration by recognized online principles confirmed by relevant International Organization for Standardization (ISO) procedures.
- Digital display indicators and output for ISO 4406 levels of 4, 6, 14, and 30 micron particle distribution sizes.
- Cost effective solution for monitoring fuel contaminant levels, filter efficiency, and reducing machine downtime.

- Continuous performance for dependable analysis.
- Hydraulic, phosphate ester & fuel fluid compatible construction.
- Fully PC/PLC integration technology using Data Acquisition CAN Bus, Serial, or Cellular output.
- Can Bus outputs allow for a "bus" type of architecture so that multiple units may be easily networked together using one main "bus" cable.
- Ability to monitor fuel quality at remote sites from anywhere an internet connection is available.
- On-board Timer which automatically turns fuel measurements on and off at selected intervals to help save pump and optics life.
- Self-diagnostic software.

### Technical Specifications

- Diagnostic self-check start-up time 5 seconds after power up
- Measurement period of 60 seconds
- Reporting interval through visual display, CAN bus, Serial, or Cellular
- Digital LED display update time every second
- Principle of operation Laser diode optical detection of actual particulates
- Reporting codes ISO 7 – 21, NAS 0 – 12, (AS 00 – 12 contact Parker)
- IPM-200 Series will also report less than ISO 7, subject to the statistical uncertainty defined in ISO4406:1999, which is shown in the RS232, reporting results as appropriate e.g. "<6"
- Calibration By recognized on-line methods, confirmed by the relevant International Standards Organization procedures
- Calibration recommendation 12 months
- Performance +/- 1 ISO Code (dependent on stability of flow)
- Reproducibility / Repeatability Better than 1 ISO Code
- Hydraulic connection M16 x 2 hydraulic test points
- Flow range through the device is approximately 100 ml/min (optimum flow = 60ml/min)
- Viscosity range 10 to 500 cSt
- Operating fluid: 0°C to +85°C (+32°F to +185°F)
- Working pressure 2 to 7 bar (30 to 100 PSI)
- User friendly construction materials

- Locking all steel enclosure
- Viton seals
- NEMA, IP66 Rating

#### **Software Default Settings**

Comms echo	Off
Verbose errors	Off
STI Sensors used	Off
Reporting standards	ISO
Factory Set Particle Limits	14/13/12/10
Measurement period	60 seconds
Reporting interval	30 seconds
Power-on mode	AUTO
Auto start delay	5 seconds
Date format	dd/mm/yy

#### **1.1 PRINCIPLES OF OPERATION**

The IPM-200 SERIES measures particle contamination continuously using a proprietary laser obscuration concept, updates the display and output report every second, and does not perform a 'one-off' test. This means that even with a Measurement Period of 60 seconds, the display and output report the presence of dirt in the fuel in just a few seconds - it does not wait until the end of the Measurement Period before reporting the result.

The Measurement Period can be set from five seconds to 180 seconds using a Serial Communication Cable and IcountPD software (See Section 3.3 for more information on this). The longer the Measurement Period, the more contaminant is measured, averaging out any spikes seen on a smaller sample. The shorter the Measurement Period the more sensitive the icountPD is to small slugs of contaminant, but also the performance on clean systems can be reduced. Thus, the user can select how sensitive the icountPD is to spikes of contaminant, and how quickly it responds to contamination levels above the set point ('limits').

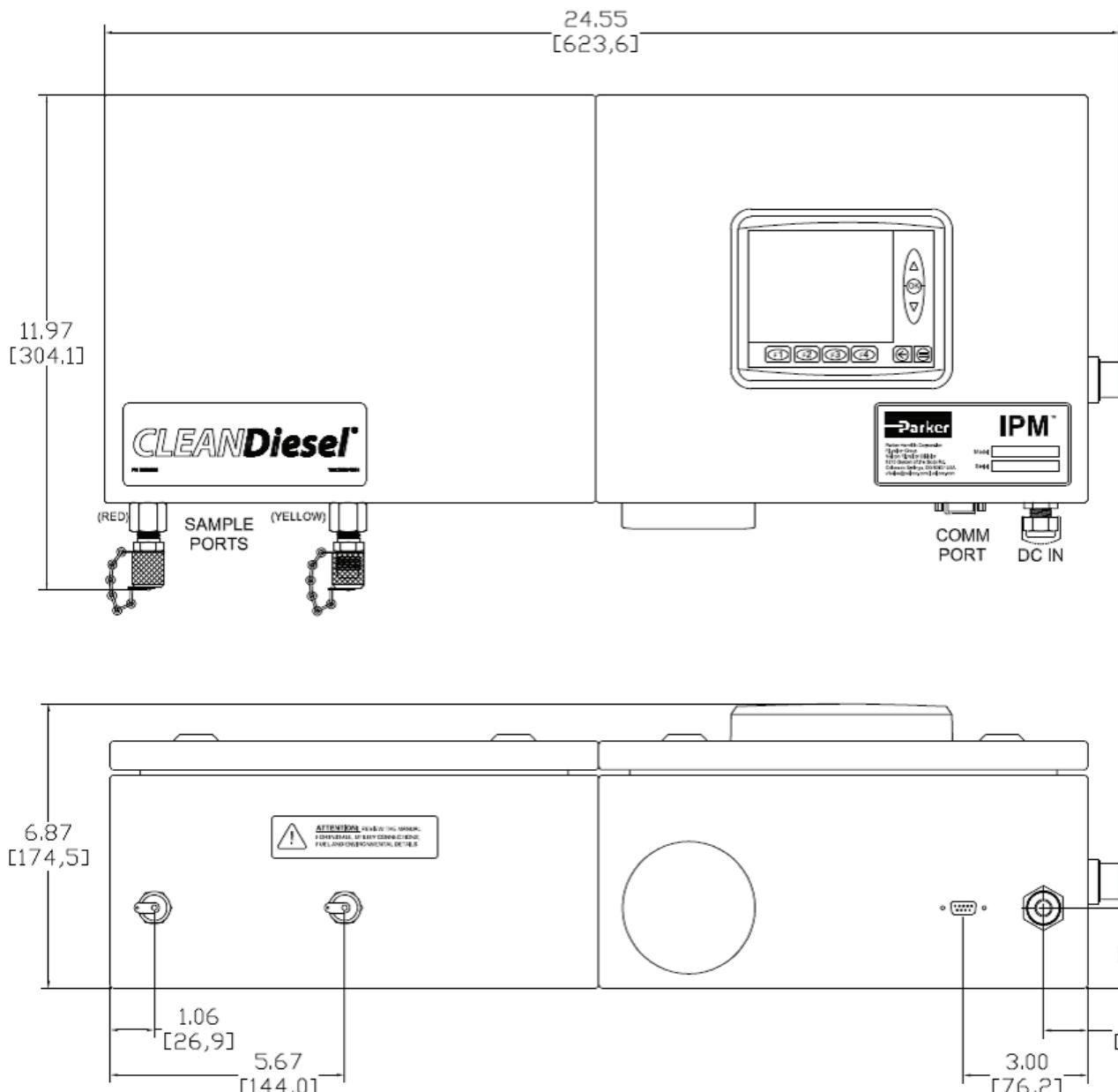
With a Measurement Period of 100 seconds, the results will be for the last 100ml of fuel that has flowed through the icountPD, updated on a second-by-second basis, giving an effectively continuous readout of the level of contamination. See the Parker icountPD manual for more information on this.

#### **1.2 PHYSICAL PARAMETERS**

- Overall Dimensions:  
11.0" H x 23.5" W x 6.1" d (279,4mm x 299,7mm x 154,9mm)
- Weight: 26 lbs. (11.79kg)
- Storage Temperature:  
-40°F to +176°F (-40°C to +80°C)
- Storage Humidity:  
Range 5% RH to 100% RH
- Operating Temperature:  
Environment: -20°C to +60°C (-4°F to +140°F)
- Operating Humidity:  
Range 5% RH to 100% RH

**1.3 MECHANICAL REQUIREMENTS****Installation / Mounting Recommendations**

- It is highly advised to mount the IPM-200 Series out of direct sunlight.
- The IPM-200 Series will require an overall envelope of approximately 12"W x 24.5H"x 6.9"D (304,1mm x 623,6mm x 174,5mm), with clear access to the front panel, bottom power input run, and CAN Bus/RS232 connector, and fuel ports.



IPM-200 Series Required Overall Size Envelope

## 1.6 SAFETY CONVENTIONS

Sign	Description
	<b>Caution!</b> In this document, this symbol expresses the need for extreme caution when performing the documented procedure. Failure to do so may cause harm to the user or the permanently damage the IPM unit.
	<b>Important!</b> This symbol expresses an important point or step in a procedure. Stop and read carefully before continuing.
	<b>Note!</b> This symbol expresses an important point to take note of for future reference.

## 2 INSTALLATION

### 2.1 INSTALLATION PRECAUTIONS

Ensure that the power supply is disconnected before any maintenance/inspection is carried out. Please contact Parker Hannifin in the unlikely event of the icountPD being faulty or damaged.

It is not the intention of Parker Velcon to have the IPM-200 Series unit operate in conditions where there is a NORMALLY occurring explosive mixture of gases, vapors, mists or air/dust mixtures.

**Fuel Compatibility** – The following table lists the compatibility of the IPM-110 with common fuels.

JET-A1	Compatible
JET-A	Compatible
JET-B	NOT Compatible
JP-8	Compatible
Aviation Gasoline (Avgas, Aviation Spirit)	NOT Compatible
Diesel (all grades)	Compatible
Motor Gasoline or Petrol	NOT Compatible

## 2.2 PACKAGE CONTENTS

### 2.2.1 Inspect shipment

Upon receipt of your IPM-200 Series unit and before continuing, carefully remove and inspect the contents of the carton for damage or missing components. If any damage is visible, or components are missing from the carton, contact Parker Velcon immediately for disposition.

The IPM-110 system should consist of the following core components;



Quantity	Description
1	IPM-200 Series Unit Enclosure
1	Installation and Operation Manual
1	icountPD User Manual and Utility Setup CD
1	Sampling Hose Set, 2 m long, P/N ACC6NN003
1	Probe, Twin Sample Port, P/N ACC6NN046
1	Mounting Hardware Kit
1	Enclosure Lid Key

## 2.3 MOUNTING INSTRUCTIONS

### 2.3.1 Tools Needed

The IPM-200 Series unit enclosure is supplied with a mounting hardware kit, which includes four (4) brackets and associated bolts. The enclosure can be bolted directly to a supporting surface by removing the plastic plugs from the holes in the backside of the enclosure and assembling the fastening hardware through the holes and securing it to the supporting surface. The user has the option of installing the enclosure by securing the mounting brackets to the enclosure which allows access to the hanging fasteners from outside the enclosure.

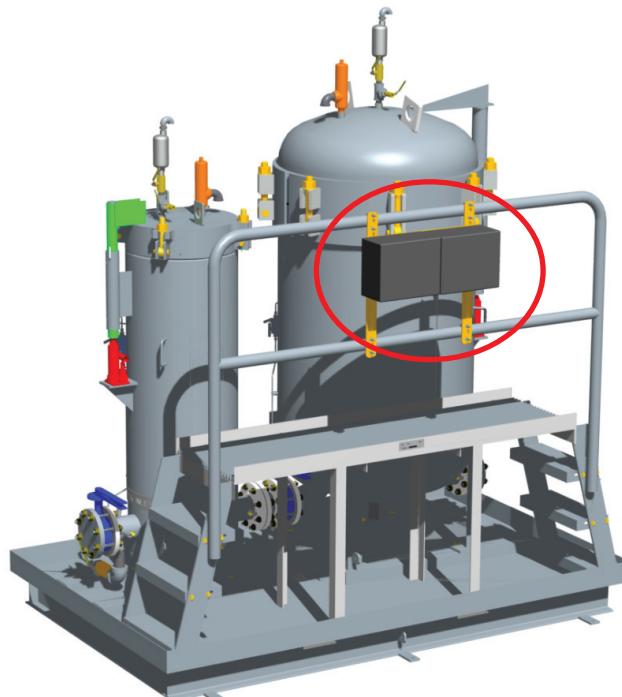
The following is a list of tools that may be needed for a typical IPM-200 Series installation;

- Drill
- Drill bits as outlined below
- Wire strippers/cutters
- Digital multimeter with DC voltage and mA current functions

### 2.3.2 Determine IPM-200 Series Unit Installation Location

Select an area which best suits the location of the IPM-200 Series unit, taking into consideration the following criteria;

- The IPM-200 Series contains sensitive instruments & should not be exposed to temperatures above 120°F (49°C).
- Avoid mounting the unit where it will be exposed to direct sunlight.
- Install in an area which is easily viewed and accessible by operators.
- Install in an area which allows access via 2m hoses, to the desired Sample Port location.
- Install in an area which will allow for strict adherence to local and international EPA guidelines.
- Install in an area which employs a secondary fuel containment system such as a spill tray and waste return line.



Typical IPM-200 Series Mounting Location  
on a Diesel Fueling Skid

### 2.3.3 Drill / Tap Module Mounting Holes

#### Direct Mount Method

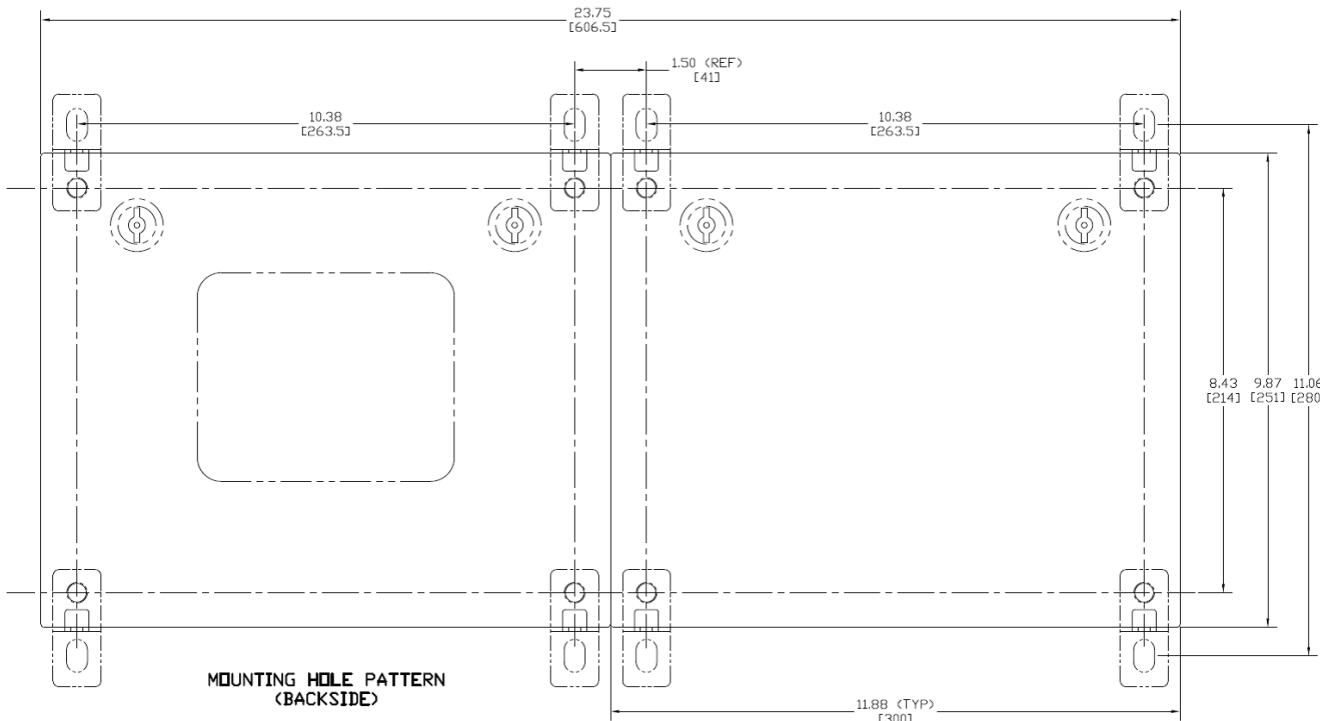
Once the installation location has been selected for the IPM-110/115 unit, transfer the location of the mounting holes on the backside of the enclosure.

- Drill through holes for the 10mm screws supplied in the mounting kit, a typical drill size would be 7/16" or 11mm clearance holes.
- Using the 10.38" x 8.43" [263,5mm x 214mm] hole pattern shown in diagram.

#### Mounting Bracket Mount Method

Once the installation location has been selected for the IPM-200 Series unit, fasten the mounting bracket hardware included in the kit to the back of the enclosure. Transfer the location of the holes in the mounting brackets.

- Drill through holes for the mounting screws (not included), a typical screw size would be 3/8-16UNC or 10mm, which would require a 7/16" or 11mm drill size for clearance holes.
- Using the 10.38" x 11.06" [263,5mm x 280mm] hole pattern shown in diagram on next page.



Overall Dimensions and Mounting Hole Pattern

### 2.3.4 Prepare and Install the IPM-200 Series Unit Enclosure

#### Direct Mount Method

The enclosure mounting holes for the IPM-200 Series unit are accessible only from the inside of the enclosure; therefore, the following steps will need to be taken to access them.

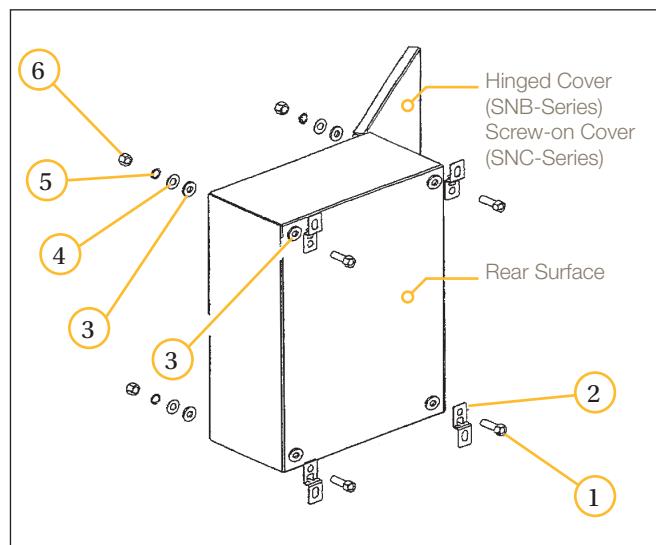
- Open the lid of the IPM-200 Series Unit enclosure using the key provided.
- Remove the plastic plugs that are installed in the enclosure mounting holes.
- Assemble the fastening hardware through the support surface and enclosure surface as shown in the diagram below.

#### Mounting Bracket Mount Method (optional)

The enclosure mounting holes for the IPM-200 Series unit are accessible only from the inside of the enclosure; therefore, the following steps will need to be taken to access them.

- Open the lid of the IPM-200 Series Unit enclosure using the key provided.
- Remove the plastic plugs that are installed in the enclosure mounting holes.

- Assemble the optional Mounting Brackets to the enclosure using the fastening hardware supplied with the unit as shown in the diagram above.
- Fastening Mounting Bracket to the support surface with customer supplies fasteners.

Mounting Hardware shown  
for One Side of the IPM-200 Series

MOUNTING KIT HARDWARE LIST		
Item #	Description	Qty.
1	Hex Bolt - M10 x 20mm Long	4
2	Mounting Bracket (optional)	4
3	Sealing Washer - 6mm ID x 20mm OD	4
4	Flat Washer - M10 x 20mm	4
5	Split Lock Washer - M10	4
6	Hex Nut - M10	4

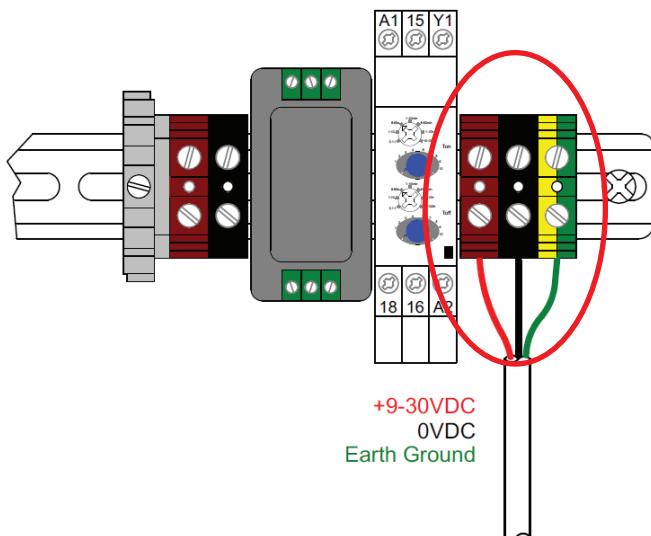
## 2.4 INPUT POWER



**CAUTION** - Use 9-30 VDC ONLY to power the IPM-200 Series. Connecting this device to AC power will cause unit failure and could result in injury.

- Use a cable size and wire gage appropriate for the power supply being used. This is recommended to be a three conductor cable, with 22 AWG or lower stranded copper wire.
- Input power is in the form of +9-30VDC only. It is recommended that a three conductor cable be used for input power. Connect each of the three wires (+VDC, 0VDC, and Earth ground) to the terminal block as shown below. Before making any connections, determine the polarity of your power cable using a multimeter and mark if needed.

VOLTAGE INPUT

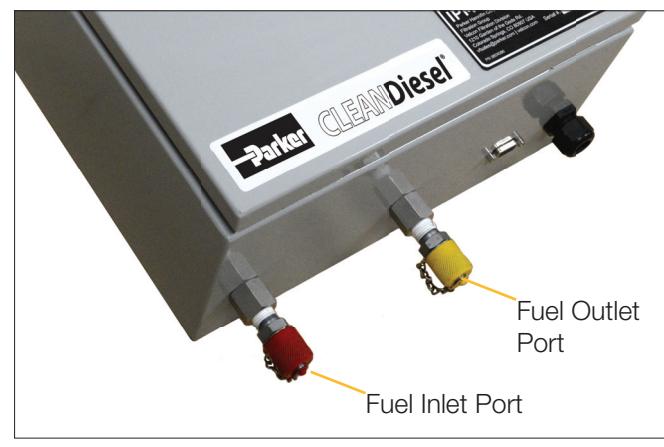


Power Connections to the Input Terminal Block

## 2.5 FUEL SUPPLY LINE CONNECTIONS

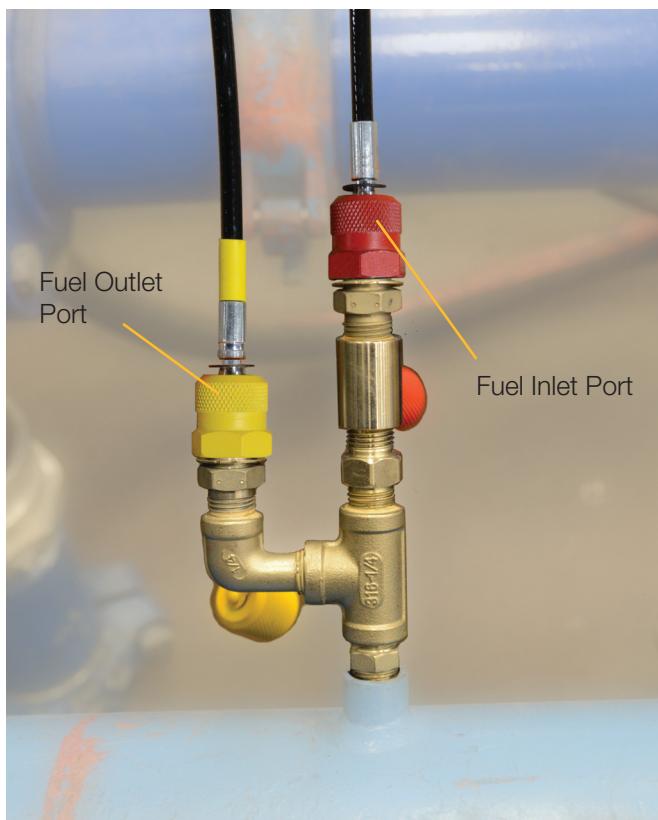
The IPM-200 SERIES is equipped with an input and an output fuel supply line connection. The internal pump pulls fuel through at a rate of 100 mL/min. The unit can withstand a differential pressure of up to 80 psi, however, if a differential pressure is expected to be greater than 80 psi, a separate regulator must be installed in line with the input supply connection. In a normal operating situation, there will be no difference in pressure between the input and output fuel ports.

The input fuel port is the left-most port on the bottom side of the enclosure as viewed from the front, and designated by a red cap. The output fuel port is right-most port on the bottom of the enclosure as viewed from the front, and designated by a yellow cap. It is important that the two ports are not crossed when connecting the supply line hoses.



Fuel Sample Ports

The Twin Sample Port (P/N ACC6NN046) has an input and output port which are also designated by red and yellow caps respectively. The Twin Sample Port requires a standard  $\frac{1}{4}$ " NPT thread half-coupling or equivalent for installation. The location of the Sample Port installation is entirely dependent on whether it is desired to sample incoming fuel before it reaches filtration, after the fuel is filtered, or both. It is recommended to place the sampling ports in areas of pipework which are easily accessible, and make for easy tubing runs to the IPM-200 SERIES enclosures



IPM-200 Series Twin Sample Probe

The IPM-200 Series comes supplied with two 2m long Sampling Hoses (P/N ACC6NN003), one for fuel inlet and one for fuel outlet.

**Note:** The fuel ports on the IPM-200 SERIES cabinets as well as the Twin Sample Port have built in ball valves which shut fuel flow off when the Sampling Hoses are disconnected. When a Sampling Hose is connected to either of these ports, a pin in the hose connection releases the ball valve in the port, and fuel will begin to flow.

### 2.5.1 Fuel Port and Hose Connection Order

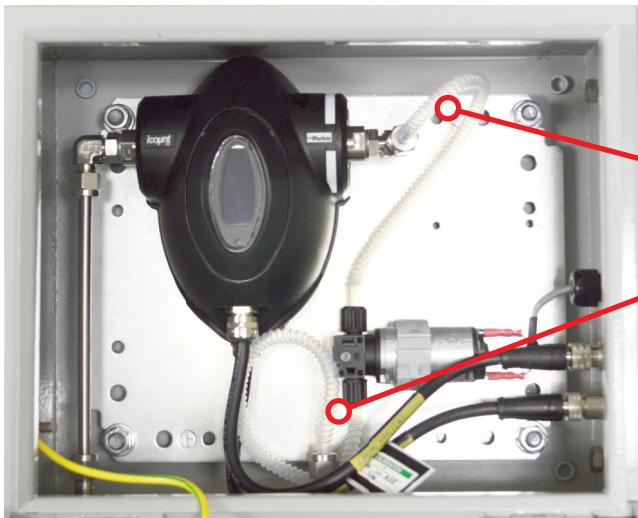
The following steps outline the hose connection procedure to ensure minimum fuel spillage and priming of the IPM-200 SERIES pump. Make certain to adhere to local and international EPA guidelines, and take proper precautions when performing the IPM-200 SERIES installation to prevent and contain any fuel spillage that may occur. A small fuel container will be needed to complete the final connection and priming process as described below. The IPM-200 SERIES is designed to operate at zero differential pressure, however, when connecting or disconnecting line hoses, a line differential pressure will likely be present but should never exceed 80 psi. If a pressure of greater than 80 psi is present within the pipework where the IPM-200

SERIES will be installed, it is recommended to install a pressure regulator prior to installation.

### Making Fuel Line Connections to Pipelines

1. Once the IPM-200 cabinet is installed and wired per Section 2.1 above, Shut the fuel supply down, close the appropriate valves, and relieve any line pressure.
2. Drain the section of pipe in which a Sampling Port is to be installed if necessary.
3. Install a Sampling Port using appropriate Teflon tape.
4. Open the appropriate valves to re-fill the section of pipe, and return the line back to normal pressure.
5. Connect both the INLET Sampling Hose (red caps) and OUTLET Sample Hose (yellow caps) to the valves on the IPM-200 SERIES enclosure.
6. Position a fuel container under the loose end of the OUTLET Sample Hose (yellow cap) BEFORE attempting step 7.
7. Connect the loose end of the INLET Sampling Hose (red caps) to the INLET side (red cap) of the Twin Sample Port. The purpose of this to create some positive pressure on the inlet side of the IPM-200, to prime the pump, and remove all air from the Teflon lines.
8. Energize and run the IPM-200 SERIES until a solid stream of fuel can be seen flowing within the Teflon lines while draining the fuel into the fuel container.
9. De-energize the IPM-200 and connect the loose end of the fuel OUTLET Sample Hose to the Sample Port.

The IPM-200 is now set to run whenever a fuel sample reading is desired.



Continue to flow fuel until all air is void from the Teflon lines and a solid stream of fuel is present.

**Teflon Pump Lines Must be Void of Air when Priming the System**

## 2.6 DRAIN HOLE AND RETURN LINE

The IPM-200 SERIES is designed to be separated into two separate compartments – The pump side, and the electrical side. The two compartments are liquid sealed from one another to keep potential fuel leaks away from any electrical components. The unit is equipped with a drain hole at the bottom of the pump enclosure. It is recommended that a return drain line be installed to return leaking fuel back to the pipeline in the case of pump or circulation line failure. If it is impractical to use a return line, it is recommended that secondary fuel containment measures be taken such as a spill tray, to eliminate the possibility of fuel contaminating surrounding soil or other equipment.

## 3 OPERATION

### 3.1 GENERAL OPERATION

To conserve pump and laser optics components longevity, it is highly recommended that the system remain powered down except when a fuel sample reading is desired. See the following two sections for more information.

When the IPM-200 Series is energized, fuel is simply drawn in one side of the Sample Port (red cap), and circulated back out through the other side of the Sample Port (yellow cap).

#### 3.1.1 Power Switch



The SYSTEM Power Switch can be set to OFF, ON, or TIMER positions. When in the ON position, the unit is fully powered with pump and optics running full time. When in the TIMER position, the On-board Timer controls power cycling to the optics and pump. See the next Section for more information on setting up the Timer Module.

#### 3.1.2 On-Board Timer Module

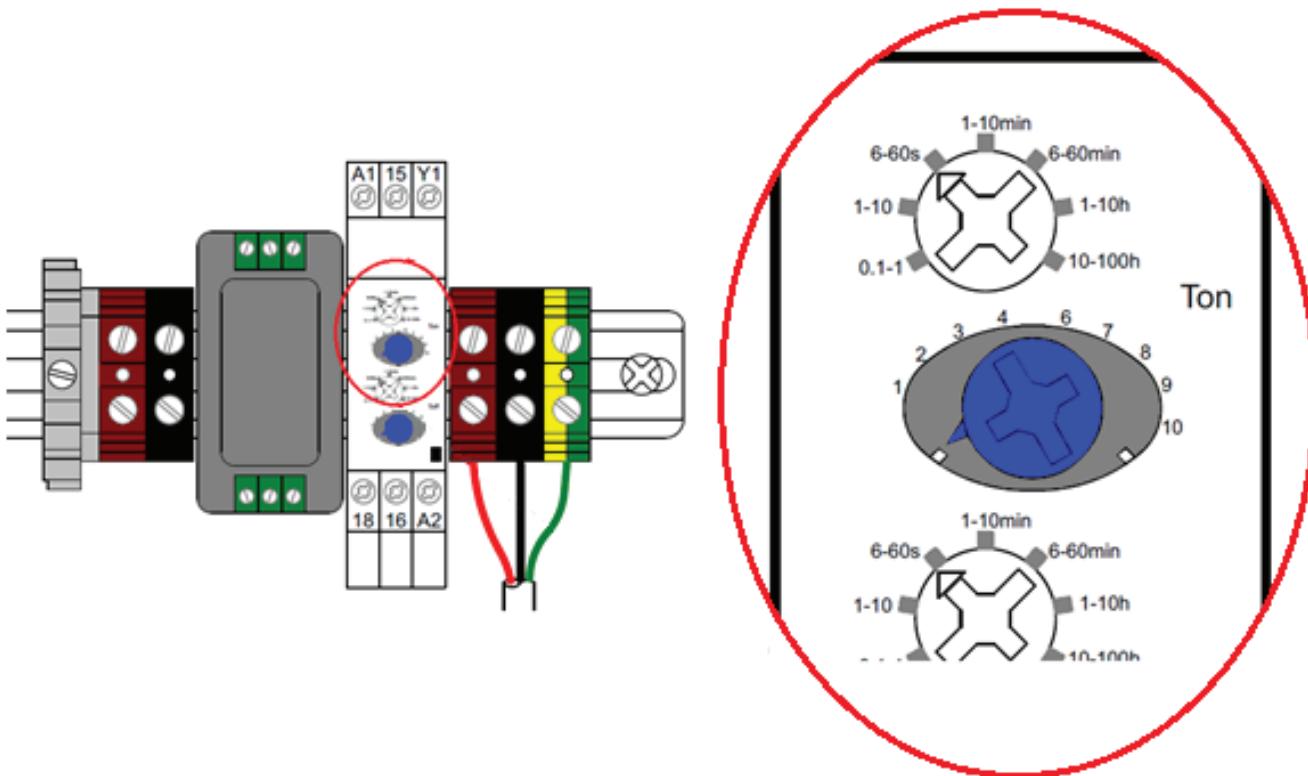
The IPM-200 SERIES comes equipped with an On-board adjustable asymmetrical Timer Module. This Timer allows the unit power to be cycled on and off automatically, controlling power to the critical components at selected intervals to prevent the Pump and optics from running full time.



The IPM-200 SERIES On-board Timer is meant to be a simple power cycle device only. If more precision time cycling is required, such as time on periods at very specific times of the day, it is recommended that the IPM-200 SERIES be controlled using the input power supply. If the unit is set up to be controlled by the external power supply, all components including the Cellular or Telemetry Module will be power cycled. This may require cellular re-connection each time the unit powers on.

When the Power Switch of the IPM-200 SERIES is in the "TIMER" position, the On-board Timer Module will be in the power circuit, although the Cellular Telemetry unit

icount Setup Utility Software Used to Configure Operating Parameters

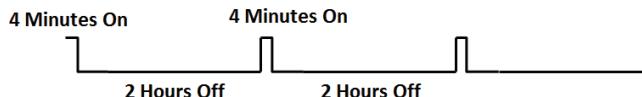


Adjustable On-Board Timer Module Setting Controls

will remain powered at all times to keep an established connection.

There are two independent “zones” on the Timer Module – one for Time On, and one for Time Off. The top zone, designated as Ton controls the ON time period of the power cycle, while the bottom zone, designated as Toff controls the OFF time period. The control adjustments for both Ton and Toff zones are identical, and can be adjusted anywhere from 0.1 second to 100 hours. The top adjustment (white) of each zone is used to set the time interval, while the bottom adjustment (blue) is a multiplier. The Example Cycle Time Setup below gives a typical timing profile example.

#### ***Example Cycle Time Setup***

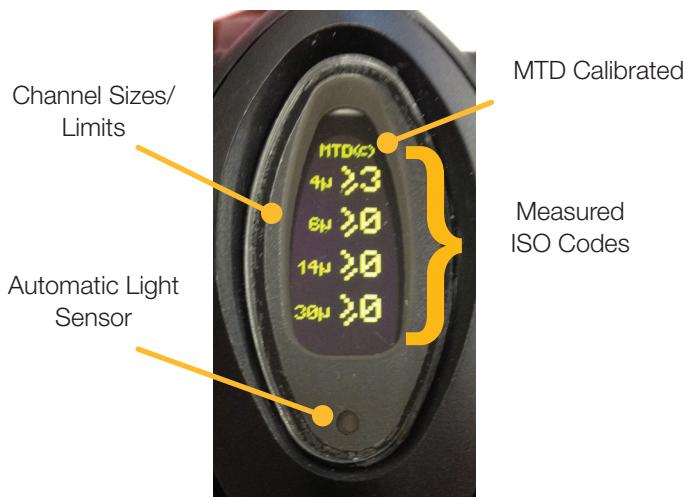


To set the IPM-200 Series unit to power on approximately four minutes after every two hours as shown in the profile above, follow the steps below;

##### **Ton Zone Setting:**

1. Set the Ton Selector adjustment to 1-10min.
2. Set the Ton Multiplier adjustment to 4.
3. Set the Toff Selector adjustment to 1-10h.
4. Set the Toff Multiplier adjustment to 2.

This timing profile will power the IPM-200 on for four minutes, followed by a time off period of two hours, then repeat the cycle indefinitely. The Timer will start the cycle in the ON state, once the SYSTEM Power Switch is cycled from the OFF position back to the TIMER position.

**3.2 DISPLAY PARAMETERS (ISO 4406/NAS 1638)**

Once the IPM-200 SERIES is powered on, a logo is displayed for approximately five seconds as a system diagnostic check is performed. When this is complete, the particle counter automatically starts monitoring contaminants.

The digital display shows the actual measured ISO 4406 codes and the size per channel (in microns). When an ISO code limit is exceeded, the Measured ISO Code number will begin to flash. The channel size and default limits will alternate. The default limits of 14/13/12/10 for the 4, 6, 14, and 30 micron channels respectively, can be changed using the iCountPD software and Serial Communication Cable. See Section 3.3 for more information about this.

When an ISO Code of 22 is exceeded for any of the four channels, an asterisk (\*) will display in place of the ISO Code. This is because the optics of the unit are calibrated for a specific range of contaminants, and when the contaminant levels exceed the optimum calibration range, accuracy diminishes. For a better understanding of ISO 4406 codes, see the table below

ISO 4406:1999 Code Chart		
Range Code	Particles per milliliter	
	More Than	Up To/Including
24	80,000	160,000
23	40,000	80,000
22	20,000	40,000
21	10,000	20,000
20	5,000	10,000
19	2,500	5,000
18	1,300	2,500
17	640	1,300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	0.64	1.3
6	0.32	0.64

Particle Size $\mu\text{m}$	Particle per mL	ISO Code 4406 Range	ISO Code
4	151700	80000 - 160000	24
6	57233	40000 - 80000	23
14	27562	20000 - 40000	22
30	2965	2500 - 5000	19

Particle Size $\mu\text{m}$	Particle per mL	ISO Code 4406 Range	ISO Code
4	520	320 - 640	16
6	173	160 - 320	15
14	37	20 - 40	12
30	11	10 - 20	11

ISO 4406:1999 Code Chart  
with Related Particle Size in Microns

## 4 COMMUNICATION

### 4.1 COMMUNICATION CONNECTIVITY AND CHANGING PARAMETERS

 The IPM-200 SERIES CANNOT communicate using both CAN bus AND SERIAL at the same time. To change the parameters of the IPM-200 SERIES such as Particle Limits and Measurement Period, it is necessary to communicate with the icountPD through a Serial protocol interface. Use Section 4.1.1 below as a guide for this function.

#### 4.1.1 Setting Up Communication Output

To communicate directly with the icountPD, a SERIAL communication protocol is necessary. See the chart below to determine what communication protocol your IPM-200 Series is set up for.

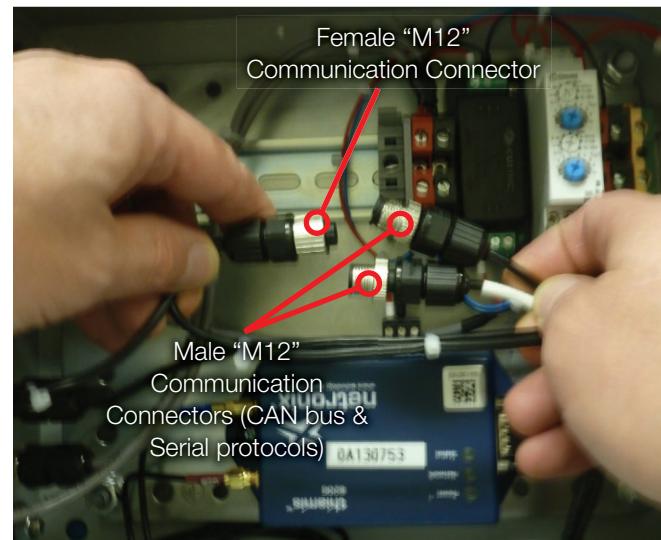
IPM-210	CAN bus Output/Serial Output
IPM-230	Cellular or Telemetry Output

#### If your IPM-200 Series unit is an IPM-230;

The IPM-210 is set up for CAN bus and Serial (RS-232) communication and will require changing the communication protocol connection to Serial to access the icountPD parameters. To do this, simply disconnect the Male CAN bus "M12" connection from the Female socket and plug in the Male SERIAL "M12" connector. Serial communication can now be established between the DB9 connector at the bottom of the IPM-210 enclosure and a PC or laptop computer. Once all desired parameters are adjusted, return the Male CAN bus connection.

#### If your IPM-200 Series unit is an IPM-230

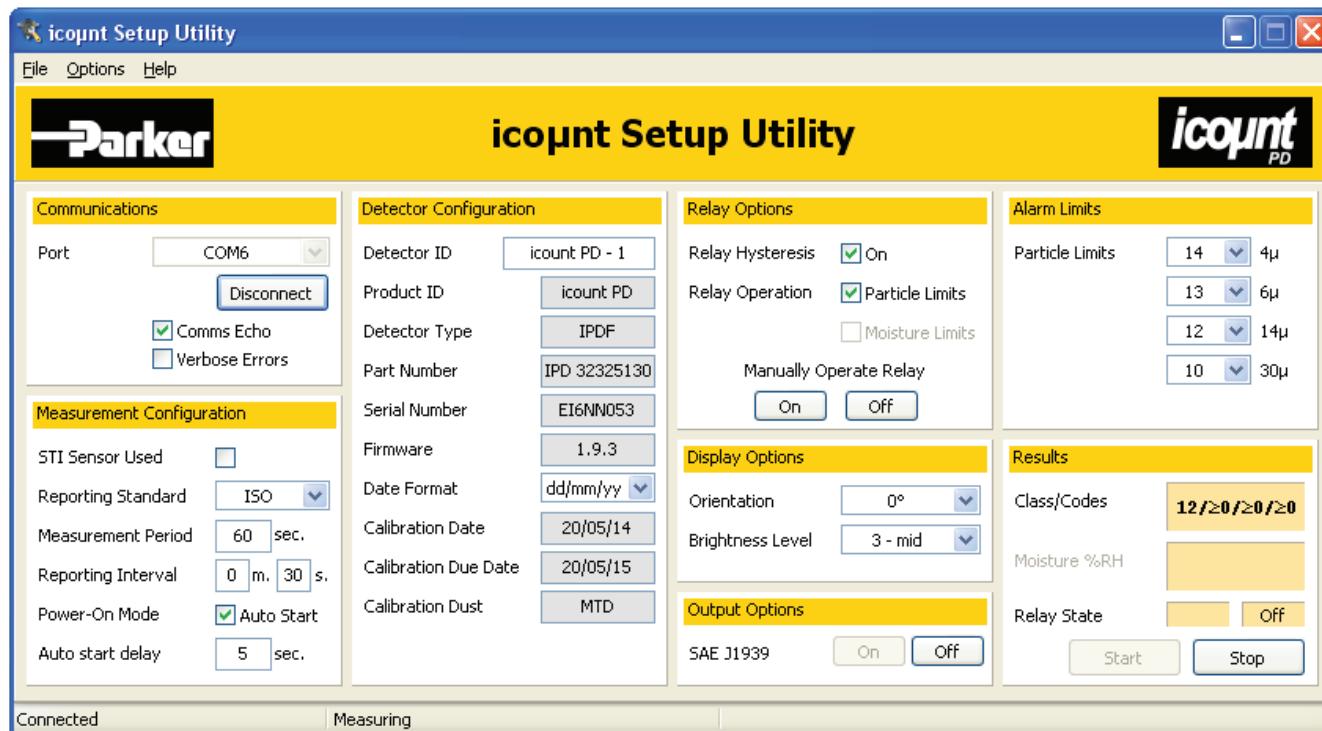
The IPM-230 is set up for SERIAL communication and will not require changing the "M12" connection inside the enclosure. Simply connect a serial cable from the DB9 connector on the bottom of the IPM-215 enclosure to a PC or laptop computer.



Connecting the Serial Communication Cable to the icountPD for IPM-210 Parameter Manipulation

Once communication has been established through a PC or laptop computer, the icount Setup Utility software can be used to adjust parameters such as Alarm Limits, Measurement Period, and Reporting Interval, as shown below.

#### 4.1.2 Changing Parameters of the IPM-200



icount Setup Utility Software Used to Manipulate icount Parameters

To change the parameters of the IPM-200, simply connect the unit to a PC or laptop using a standard serial cable. Once communication has been established through a PC or laptop computer, the icount Setup Utility software can be used to adjust parameters such as Alarm Limits, Measurement Period, and Reporting Interval, as shown above.

## 4.2 DATA OUTPUT AND NETWORK COMMUNICATION

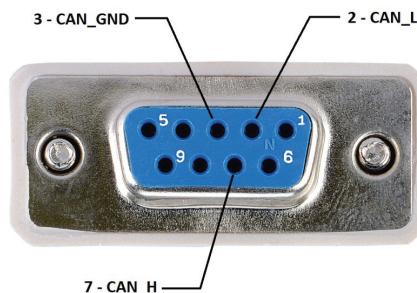
### 4.2.1 IPM-210 CAN bus Network

The IPM-210 is set up for CAN Bus network output. This output can be connected directly to a PC or laptop computer using any off the shelf CAN Bus to USB converter (Shown below) and CAN monitoring software. It is the responsibility of the end user to develop any special CAN Bus network, user interface or required integration to existing control database or SCADA system.



CAN Bus to USB converter and CAN Monitoring Software

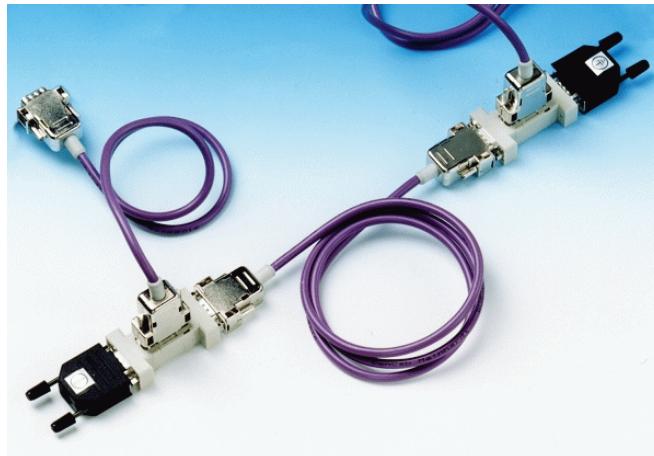
For many applications, several IPM-210 Units will be “Bussed” together in a network configuration with one main signal cable or “Bus” being run to a central database. This may necessitate the need for special cabling beyond the use of an off the shelf serial extender cable. To accommodate this, the CAN Bus Output Connector is shown below; with DB9 pin numbering and active CAN communication pins.



IPM-210 CAN Bus Output Connection Face with Pin Numbering

The following list shows rules which are to be followed when installing a CAN-network:

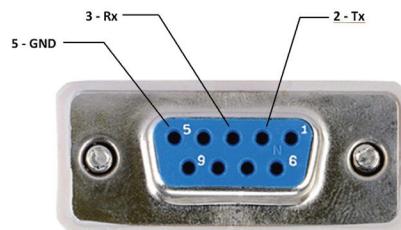
1. The net must be terminated at both ends with a resistor in the range of  $118 < R_T < 130$ , between the signals CAN\_L and CAN\_H.
2. The reference potential 'CAN\_GND' has to be connected at one point to earth potential. There has to be exactly one connection to earth.
3. When using double shielded cables, the outer shield has to be connected to the earth potential at one point. There must not be more than one connection to earth.
4. Dead-end feeders must be kept as short as possible ( $l < 0.3$  m).
5. A suitable cable type has to be used. Always take into account the voltage loss in the cable.
6. Be sure to avoid wiring CAN-lines directly next to disturbance sources. If this cannot be avoided, always use double shielded cables.



Typical CAN Bus Network Wiring Architecture  
with Male and Female Termination

#### **4.2.2 IPM-215 SERIAL (RS-232) COMMUNICATION**

The IPM-215 is set up for **serial (RS-232)** communication. Like the IPM-210, this output can be connected directly to a PC or laptop computer, and it is the responsibility of the end user to develop any special serial network, user interface or required integration to existing control database or SCADA system.



IPM-215 Serial (RS-232) Output Connection Face  
with Pin Numbering

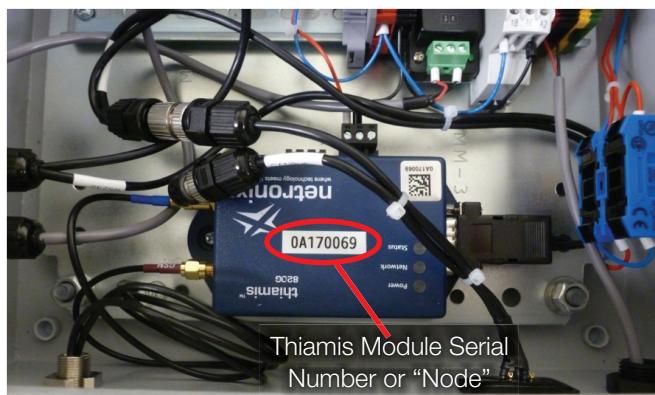
#### **4.2.3 IPM-230 CELLULAR OR TELEMETRY COMMUNICATION**

The IPM-230 is set up for Cellular or Telemetry communication, and utilizes a "thiamis" Telemetry Module. The IPM-230 uses **serial (RS-232)** communication as an input to the thiamis Module and is also linked directly to the DB9 connector on the bottom of the IPM enclosure. This output can also be connected directly to a PC or laptop computer if desired.

## 5 CELLULAR OR TELEMETRY FOR IPM-230

### 5.1 IPM-230 CELLULAR OR TELEMETRY SETUP AND USE

The IPM-230 utilizes a third party Cloud Based interface and data system operated by Environet. Various different thiamis telemetry modules are available depending on what carrier will be used. For more remote areas, a general carrier module is available at a slightly elevated subscription fee. Parker Velcon can work with the end user to determine what carrier is available in the area within which the IPM-230 will be used.



#### 5.1.1 SETTING UP ENVIRONET ACCESS THROUGH PARKER VELCON



Upon purchase of an IPM-230, an end user e-mail address will need to be set up through Parker Velcon before the Telemetry features can be used. Please contact Parker Velcon to discuss these options.

#### 5.1.2 IPM-230 CLOUD INTERFACE AND CELLULAR CONNECTION

The IPM-230 transmits data to a secure cloud based interface and server through the thiamis module. The thiamis Module Serial Number or "Node" is the identifier for a particular IPM-230 being used. Keep in mind that whenever data is accessed through Environet – the Data Cloud Server – each IPM-230 in the list will be identified strictly by its respective thiamis Node Number.

Before the IPM-230 can transmit data wirelessly, a Parker Velcon representative will have to set up an account or 'partnership' for the customer. A specific manager for the end user organization will need to be established. Once this is complete, the end user manager will be required to accept the partnership through an email. At this point, all IPM-230 units or 'Nodes' can be connected and set up.

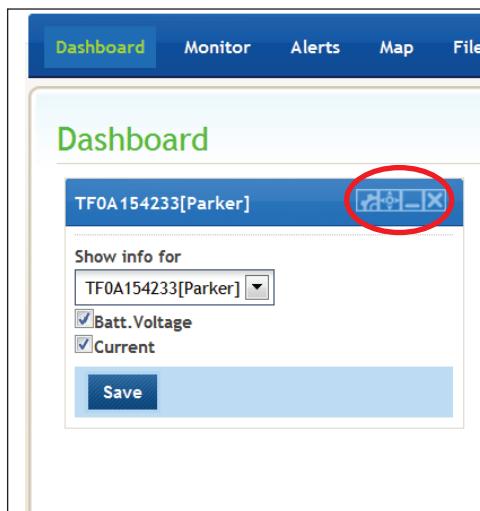
Once the IPM-230 is properly installed and powered up, and an end user manager establishes a partnership with Parker Velcon, the unit can be connected by following the steps below;

1. Connect to Environet from any Smart Phone or computer using the following web address:  
<https://ienvironet.com>
2. Enter the manager e-mail address and user password, which will bring up the following screen (below):

Total Nodes:	1
<u>Shared:</u>	0
<u>Leased:</u>	0
<u>Activated:</u>	1
<u>Reporting:</u>	1
<u>Not Reporting:</u>	0
<u>Hibernated:</u>	0
<u>Deactivated:</u>	0

It is suggested to go through all of the tutorials within the Environet GUI to get a good idea of how to set up and manipulate sensor parameters with the environment.

3. To add 'Nodes' to the interface, Dashboard, then Add Widget. Several Nodes can be added to this screen. Each time another Widget is added, click the cog wheel to configure the Widget or Node being added.



## 6 CALIBRATION RECOMMENDATIONS

### 6.1 SUGGESTED CALIBRATION INTERVAL

It is recommended that the IPM-200 SERIES be calibrated every 12 months. A calibration reminder notice will be automatically sent out 30 days prior to the calibration due date along with a Returned Material Authorization number. Velcon's calibration system is set up such that the customer may send their IPD to the factory directly for calibration, or in the case where fuel information is required on a continuous basis, a "core" unit is exchanged.

When a core exchange is necessary, contact Velcon directly for recalibration details.

## 7 GENERAL MAINTENANCE

### 7.1 IPD REMOVAL

The IPM-200 Series is designed such that maintenance and parts replacement is straight forward and can be performed quite easily in the field. The following list outlines some general issues that may be encountered with the IPM system, along with possible causes and suggested remedies.

1. Loosen the hard tubing Compression Nut on the IPD Inlet fitting as shown below.



2. Loosen the Hex Nut on the Bulkhead Adapter and back it off as far as possible as shown at the center.



3. Slide the inlet tube out of the Compression fitting as shown at the top-right.



4. Loosen the Teflon tubing Compression Nut on the IPD Outlet fitting and disconnect the flex tubing from the fitting as shown at the top-left.



5. Remove both M12 connectors at the enclosure bulkheads as shown at the center.



6. Unscrew the two 10-32 Phillips Head Screws that hold the IPD unit to the backplane as shown at the top-right.



7. Lift the IPD unit out of the enclosure and place it in the Parker shipping container if provided. The unit is ready for return to Velcon.



**IT IS EXTREMELY IMPORTANT TO FOLLOW THE IPD REPLACEMENT PROCEDURE IN 7.2 WHEN REINSTALLING THE IPD UNIT. FAILURE TO DO SO WILL RESULT IN LEAKS AND DAMAGE**

## 7.2 IPD REPLACEMENT

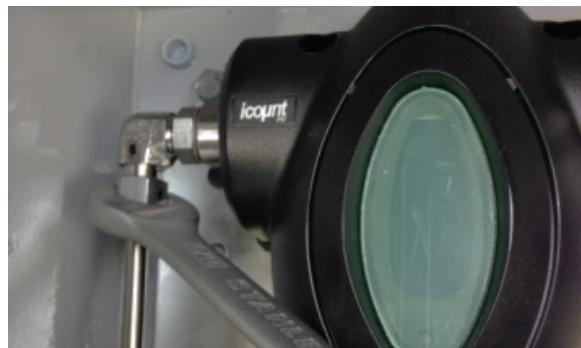
1. Fasten the IPD to the backplane using the two 10-32 Phillips Head Screws as shown at the top-left.



2. Slide the inlet tube back into the Compression fitting as shown at the center.



3. Finger tighten the Hex Compression Nut on the Bulkhead Adapter, then tighten 1/8 to 1/4 turn more with a wrench.



**DO NOT OVER TIGHTEN THE COMPRESSION NUT. DOING SO WILL DAMAGE THE COMPRESSION FITTING AND CAUSE LEAKS.**

4. Tighten the Hex Nut on the Bulkhead Adapter as shown at the top-left.



5. Finger tighten the Teflon Tube Compression Nut on the outlet fitting Bulkhead Adapter, then tighten 1/8 to 1/4 turn more with a wrench as shown at the top-center.



6. Reinstall both M12 connectors at the enclosure bulkheads as shown at the top-right.



3. Remove the wire terminals from the pump by pulling on the terminals as shown at the top-right.

 NOTE: Do not pull on the wires to dislodge the pump connection terminals.



### 7.3 PUMP REMOVAL

1. Using a screwdriver, pry open the clip on the pump mount as shown at the top-left.

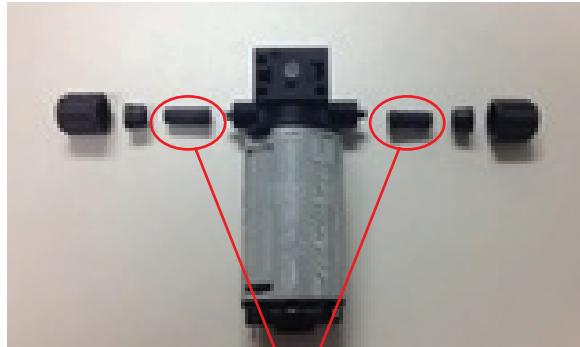


2. Loosen the tubing Compression Nuts on pump Inlet and outlet as shown at the top-center.

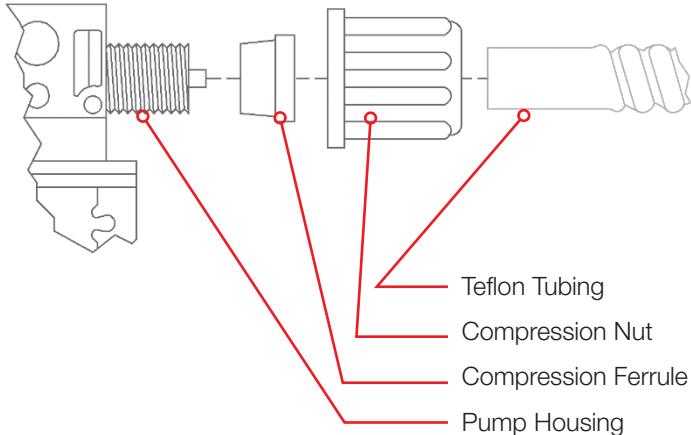


#### 7.4 PUMP REPLACEMENT

**Note: it is very important to replace the pump tubing compression components in the order and orientation shown above. Failure to do so can result in leaks and pump damage. Ensure that the pump is reinstalled in the same orientation as it was removed. Failure to do so will result in a reversed flow direction which will dead-head the pump resulting in damage or failure.**



Protective Caps - Not Used

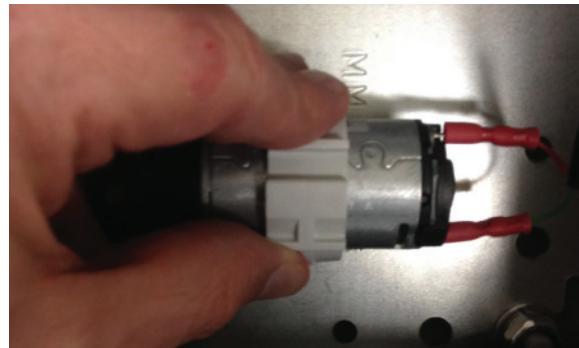


1. Remove the Compression Nut on the pump and set aside the protective caps.
2. Slide the Compression Nut over the Teflon Tubing end as shown.
3. Slide the Compression Ferrule over the Teflon Tubing end and into the Compression Nut with the orientation shown.
4. While pressing the Teflon Tubing into the Pump Housing, thread the Compression nut onto the Pump Housing threads with finger pressure until resistance is felt, then continue to turn  $\frac{1}{4}$  to  $\frac{1}{2}$  additional turn. Do not use pliers to tighten the Compression Nuts as the Pump Housing threads may be damaged or sheared off.

5. Gently pull on each Teflon Tube to ensure that it is securely seated.
6. Slide the wire terminals over the pump lugs as shown at the top-left. Ensure that the terminal secured to the RED WIRE is attached to the pump lug located at the TOP side of the pump when looking at the front of the enclosure as shown below.



7. Return the pump to the cradle in the orientation shown below and squeeze both sides of the cradle firmly until the latch catches.



8. Reinstall both M12 connectors at the enclosure bulkheads if removed, as shown at the top-right.



**8 TROUBLESHOOTING**

- Pump
- Display
- Communication Output
- Telemetry

<b>Problem Symptom</b>	<b>Possible Causes</b>	<b>Possible Remedies</b>
No data output at the communication port.	No power to the unit, Data cable loose or disconnected.	Check power to the unit, Check all wiring connections and tighten or replace as necessary, Make sure that the correct communication cable is being used.
No display on the IPD.	No power to the unit, Broken or disconnected power wires.	Check power to the unit, Check all wiring connections, tighten or replace as necessary.
Asterisks displaying on one or more channels.	An ISO code of 22 has been exceeded.	Check fuel contaminant levels, Check for air in Teflon pump lines, Ensure fuel lines are free of air and no obstructions are present, re-prime lines as necessary.
Numbers on the IPD or data output not moving.	Fuel is not flowing through the IPD optics chamber.	Ensure fuel lines are free of air and no obstructions are present, Ensure fuel lines are properly primed, Ensure fuel is present within pipeline, Verify pump is working.
Numbers on the IPD or data output stay maxed out.	ISO codes are exceeding 22.	Check fuel contaminant levels, Check for air in Teflon pump lines, Ensure fuel lines are free of air and no obstructions are present, re-prime lines as necessary, Verify pump is working, replace as necessary.
Limit parameters not displaying desired values.	Limits have not been set correctly.	Verify limits have been set to desired values using the icount Setup Utility and reset as necessary.
Pump not running.	Loose or broken wiring connections, Pump failure	Check all wiring connections and tighten or replace as necessary, Replace pump as necessary.
No fuel flow or erratic fuel flow.	No fuel in pipeline, Air bubbles in the fuel lines, Pump failure.	Ensure fuel lines are free of air and no obstructions are present, Ensure fuel lines are properly primed, Ensure fuel is present within pipeline, Verify pump is working.
Fuel leaking within the IPM-100 cabinet.	Loose or broken fuel line or fittings, Pump failure	Check all Teflon fuel lines and fittings, Tighten or replace as necessary, Check for pump failure, Replace as necessary.

**TERMS AND CONDITIONS ON MANUFACTURED PRODUCTS**

**EXCLUSIVE LIMITED WARRANTY**

THE PRODUCTS SOLD HEREUNDER SHALL BE OF A MERCHANTABLE QUALITY AND SHALL CONFORM TO SELLER'S CURRENT STANDARD SPECIFICATIONS OR SUCH OTHER SPECIFICATIONS AS SHALL HAVE BEEN MADE EXPRESSLY A PART OF THIS CONTRACT. SELLER MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, OF FITNESS FOR A PARTICULAR USE, PURPOSE OR OTHERWISE, WHETHER USED SINGLY OR IN COMBINATION WITH OTHER PRODUCTS OR IN ANY PROCESS.

**LIMITATION OF LIABILITY**

Defective or nonconforming products shall be repaired or replaced by Seller without additional charge, or in lieu thereof, at Seller's option, Seller may refund the purchase price upon return of the products at Seller's expense. NOTWITHSTANDING THE ABOVE AND REGARDLESS OF THE CIRCUMSTANCES, SELLER'S TOTAL LIABILITY TO BUYER FOR ANY AND ALL CLAIMS, LOSSES OR DAMAGES ARISING OUT OF ANY CAUSE WHATSOEVER, WHETHER BASED IN CONTRACT, NEGLIGENCE OR OTHER TORT, STRICT LIABILITY, BREACH OF WARRANTY OR OTHERWISE, SHALL IN NO EVENT EXCEED THE PURCHASE PRICE OF THE PRODUCTS IN RESPECT TO WHICH SUCH CAUSE AROSE. IN NO EVENT SHALL SELLER BE LIABLE FOR SPECIAL, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES. Any cause of action that Buyer may have against Seller and which may arise under this contract must be commenced within one year after the cause of action has accrued.

**PRICE**

Unless otherwise specified, price includes domestic packaging and transportation to the specified FOB point. Buyer will pay any additional transportation charges. Prices do not include any federal, state or local taxes, assessments, or import duties applicable to the sale, ownership, production, transportation or use of goods sold. Any such tax or duties shall be separately itemized on Seller's invoice and paid by Buyer or, in lieu thereof, Buyer shall furnish Seller with a valid tax exemption certificate. In the event Seller is required to pay any such tax or assessments, Buyer shall reimburse Seller upon demand, plus interest on such amount at the rate of ten percent (10%) per annum from the date paid by Seller. Seller shall be under no obligation to contest the validity of any such tax or assessments or to prosecute any claims or refunds or returns. Any personal property taxes or similar taxes or assessments against the goods or on account of materials segregated for the Buyer and being held by the Seller at Buyer's request shall be paid by Buyer.

**SHIPMENTS AND PACKAGING**

Unless otherwise agreed in writing, all shipments shall be FOB Seller's plant or plants, and title passed to Buyer upon delivery to carrier at such point, and packaging will be accomplished in accordance with Seller's standard commercial practice for domestic shipments. Seller may ship goods to the Buyer's place of business by such means as Seller shall select if adequate shipping instructions are not received from Buyer within sixty (60) days before the shipment date. Buyer accepts all risk of loss or damage thereto, upon delivery of goods by Seller to a carrier, shipper, forwarding agent, transporter, or Government mail box or post office, whether selected by Buyer or Seller. In no event shall Seller be responsible for any goods after delivery to such shipping means.

**PAYMENTS**

On open accounts, terms of payment are net thirty (30) days from date of invoice, unless otherwise agreed to in writing. Buyer agrees to pay Seller's finance charges (10% per annum) for late payments, and any expenses in collecting such unpaid balance and finance charges, or in recovering possession of the goods. On all other accounts, payments are FOB factory.

**ACCEPTANCE**

Buyer shall inspect all goods immediately upon their delivery to the destination stated in the Agreement and shall within ten (10) days provide written notice to Seller at its principal place of business of any claim that the goods do not conform to the terms of the Agreement. Any such notice shall specify with particularity each alleged defect or nonconformity. If Buyer shall fail to give such timely notice, the goods shall be conclusively deemed to conform to the terms and specifications of this Agreement and shall constitute an irrevocable acceptance of the goods. Any use by Buyer of the goods other than solely for test purposes, or any alteration of the goods by Buyer without Seller's prior written consent, shall be conclusive and binding evidence that the goods conform to the terms and specifications of this Agreement. If Buyer accepts or is deemed to have accepted the goods as herein above provided, Buyer shall not be entitled to revoke acceptance thereof at a subsequent time. In the event Buyer timely rejects the goods in accordance with the terms of this Agreement, Buyer shall hold the goods without charge to Seller for a reasonable time until Seller gives instructions to Buyer with respect to the goods. Should Buyer sell or dispose of the goods without Seller's written approval, such sale or disposition shall constitute an unequivocal acceptance of the goods, notwithstanding any prior rejections of the goods.

**CANCELLATIONS**

Once an order has entered the Velcon manufacturing process, or for stock items if already picked and packed, it cannot be cancelled without receiving written authorization by Velcon Management. Cancelled orders will be subject to a cancellation fee; the amount will be based on the value of the work completed but will not be less than 20% of the original order value. Please also note that some manufactured products will have a cancellation fee of up to 80% of the value of the original order.

**EXCUSABLE DELAYS**

Seller shall not be liable for damages for delays in performance due to circumstances beyond its reasonable control, including with limiting the generality of the foregoing, any priority system established by any agency of the United States Government, fires, floods, storms, and other Acts of God, accidents, strikes, insurrections, war, acts of terrorism, shortage of materials, lack of transportation and failure of performance of subcontractors and/or suppliers for similar reasons. Failure of Seller to perform for these reasons aforesaid shall not be grounds for Buyer's cancellation of its order but the delivery date shall be extended accordingly. Buyer's acceptance of late delivery goods shall constitute complete and satisfactory performance by Seller.

**PATENT INDEMNITY**

If the goods furnished hereunder are specified in this Agreement as being standard commercial supplies of Seller, Seller agrees to indemnify Buyer, its successors, assigns, agents and use of its products against loss, damage, or liability, including cost and expenses, which may be incurred on account of any suit, claim, judgment or demand involving infringement or alleged infringement of any patent rights in the manufacture, use or disposition of any goods supplied hereunder, provided Buyer shall promptly notify Seller of any suit instituted against it and, to the full extent of its ability to do so, shall permit Seller to defend the same or make settlement in respect thereto. In the event the goods furnished hereunder are produced under special specifications of Buyer, no liability under this paragraph shall arise against Seller. In like manner, Buyer agrees to save Seller harmless from patent infringements resulting from Seller's compliance with designs and/or specifications not originating with Seller now or hereafter forming a part of this Agreement or with specific written instructions given by Buyer for the purpose of directing the manner in which Seller shall perform this Agreement.

#### USE OF PRODUCTS

Seller grants no license or right, expressly or by implication, estoppel, or otherwise, beyond the right of the Buyer to use the specified goods in the form delivered by Seller. Further, Seller's products are offered for sale and are sold subject in every case to the condition that such sale does not convey any license, expressly or by implication, estoppel, or otherwise under any patent claim with respect to which Seller could grant licenses covering any other product, or any completed equipment, or any assembly, piping spool, circuit, combination, method or process in which, or in the manufacturing or testing of which, any such Seller products are used (notwithstanding that such Seller products may have been designed only for use in, or may only be useful in, such other patented products or such patented equipment, assembly, piping spool, circuit, combinations, method or process, or in the manufacturing or testing thereof, and that Seller products may have been purchased and sold for such use). Seller expressly reserves all its rights under such patent claims.

#### PROPRIETARY RIGHTS

The prints, drawings or specifications of Seller attached hereto or hereafter furnished by Seller to Buyer in connection with the obtaining or the performance of this Agreement are the property of the Seller and represent a proprietary article with respect to which Seller retains all United States or foreign letters patent, trademarks or copyrights, including exclusive rights of use, manufacture and sale. Possession by Buyer of such prints, drawings or specifications does not convey any permission to manufacture, use or sell any goods shown thereon and such information is disclosed to Buyer on a confidential basis.

#### COMPLIANCE WITH LAWS AND REGULATIONS

Buyer agrees to indemnify and hold Seller harmless against all losses, claims, causes of action, penalties and liabilities arising out of Buyer's failure to comply with all applicable federal, state and local laws, ordinances, regulations, rules and orders.

#### TERMINATION

If Buyer fails to comply with any of the provisions hereto, or becomes the subject of a proceeding under state or federal law for relief of debtors, or makes an assignment for the benefit of creditors, Seller shall have the right to hold Buyer in default and, in addition to any other rights it may have, may cancel this Agreement in whole or in part.

#### EFFECT OF INVALIDITY

The invalidity in whole or in part of any provision hereto shall not affect the validity of any other provisions.

#### CREDIT

Seller reserves the right at any time to alter or suspend credit, or to change credit terms provided herein, when in its sole opinion the financial condition of the Buyer so warrants. In such case, in addition to any other remedies herein or by law provided, cash payment or satisfactory security from Buyer may be required by Seller before shipment, or Seller may, at its option, defer further shipments to Buyer until Buyer reestablishes satisfactory credit, cancels the unshipped portion, with a twenty-five percent (25%) cancellation fee, of the order without any liability for failure to ship, or makes shipments to Buyer on a prepayment basis. Payments made by trade acceptances, notes, securities, postdated checks, etc. are unacceptable unless first approved in writing by Seller.

#### REMEDIES

The rights and remedies provided Seller herein shall be cumulative, and in addition to any other rights and remedies provided by law or equity. Seller's failure to insist upon strict performance of any provision of the Agreement shall not be deemed to be a waiver of Seller's right or remedies, nor a waiver by Seller of any subsequent default by the Buyer in performance of or a waiver by Seller of any subsequent default by the Buyer in performance of or compliance with any of the terms of this Agreement.

#### ASSIGNMENT

Buyer may not assign this Agreement, or any portion thereof without the express prior written consent of Seller. Subject always to the foregoing, this Agreement insures to the benefit of, and is binding upon, the heirs, legatees, personal representatives, successors and assigns of the parties hereto, in no event shall assignment relieve Buyer of liability for performance of the obligations imposed by this Agreement.

#### ENTIRE AGREEMENT

This Agreement shall constitute the entire understanding of the parties with reference to the subject matter hereof, and it is agreed that there are no understandings, promises, representations or agreements, whether oral or written, heretofore entered into between Seller and Buyer which have any force or effect. This Agreement may be amended only by a writing signed by the parties. No agent, employee, or representative of Seller has any authority to bind Seller to any affirmation, promise or representation or warrant concerning the goods, and any such affirmation, promise, representation or warranty shall be of no force or effect unless set forth in this Agreement. The laws of the State of Colorado shall govern the formation, performance, and construction of the Agreement.

#### The Velcon Warranty

##### SYSTEMS AND ELECTRICAL COMPONENTS

Velcon does not warrant that the systems and electrical components of their products (the "Electronics") conform to any specification. Velcon warrants title to the Electronics and further warrants that the Electronics are free from defective material and workmanship when such products are installed and operated in accordance with its instructions. These warranties shall terminate one year from date of invoice.

Velcon's Electronics warranty does not extend to articles such as pumps, motors, electrical components, etc., manufactured by others. This responsibility rests entirely with the manufacturer of these articles.

The Electronics warranty is exclusive and is in lieu of all other warranties, express, implied or statutory, including the warranties of merchantability and fitness for a particular purpose.

Except in the respect to patent matters, the exclusive liability of Velcon arising out of the sale and supply of its Electronics products, the use of its Electronics products, and any related services thereto, whether a claim is made based on warranty, negligence, or otherwise, shall be, at Velcon's option, to correct the defect, replace the product or repay the purchase price. In the event of correction or replacement, the purchaser will be responsible for all transportation and labor costs.

In no event shall Velcon be liable for indirect, consequential or special damages.

No change in this warranty shall be binding upon Velcon unless in writing and signed on its behalf by its CEO.

All orders, sales and contracts are subject to Velcon's standard conditions of sale in effect at the time of our acceptance.

Parker Hannifin Corporation  
**Velcon Filtration Division**  
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Colorado Springs, CO 80907  
phone 719 531 5855  
[www.velcon.com](http://www.velcon.com)

